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HAWAII AGRICULTURAL EXPERIMENT STATION
HONOLULU, HAWAII

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UNIVERSITY OF HAWAII
and the
UNITED STATES DEPARTMENT OF AGRICULTURE

CIRCULAR NO. 5

POULTRY DISEASES COMMON IN HAWAII

BY

C. M. BICE, Poultry Husbandman

Issued September, 1932

Published by the
University of Hawaii
Honolulu, T. H.

HAWAII AGRICULTURAL EXPERIMENT STATION
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(Under the joint supervision of the University of Hawaii, and the Office of Experiment Stations, United States Department of Agriculture.)

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POULTRY DISEASES COMMON IN HAWAII

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C. M. BICE, *Poultry Husbandman*

TABLE OF CONTENTS

Page
Sanitation 4
  Houses 4
  Ventilation 4
  Feeds 5
  Water for drinking 5
  Soil 5
  Exercise 6
  Parasites 6
  Disposal of sick birds 6
  Disposal of dead birds 6
  Disinfection 6
Simple Catarrh (colds) 13
Contagious Catarrh 14
Infectious Bronchitis 15
Fowl Cholera 17
Leukemia 18
Bacillary White Diarrhea of Chicks 18
Sorehead (fowl pox) 21
Coccidiosis 22
Aspergillosis (brooder pneumonia) 24
Prolapse of Oviduct 25
Bumblefoot 26
Limberneck (botulism) 26
Cannibalism 28
Manson's Eyeworm 29
Roundworms 30
Tapeworms 31
Lice 33
Mites 34
Sticktight Flea 36
Literature Cited 38

INTRODUCTION

During the last five years there has been a decided increase in the number of chickens in the Territory of Hawaii. This fact, coupled with the practice of keeping them on small areas, has led to outbreaks of several diseases. Some of the more important poultry diseases have been introduced with the importation of stock for breeding and for the market, and have resulted in a high death rate in both chicks and laying hens.

SANITATION

In Hawaii, as elsewhere, sanitation is the keynote to successful poultry raising, more especially where large numbers of birds are raised on limited areas. As an important step in the direction of sanitation, the poultryman should make every effort to delay, and if possible to prevent, attacks by disease in his flock. After disease has entered the flock he should do what he can to limit its spread and to hasten its eradication. Most of the more common diseases can be controlled, and even prevented, by the use of sanitary measures. Vigorous and healthy birds, as well as the weaker members, should be safeguarded from disease, for vigor of stock will not hinder disease-transmitting agencies from finding their way into the flock. The best assurance for success over a long period of years is the recognition of such factors that play an important role in keeping disease from the flock (*17*).[1] Ten factors may be said to influence the effectiveness of sanitation on poultry: (1) Houses; (2) ventilation; (3) feeds; (4) water for drinking; (5) soil; (6) exercise; (7) parasites; (8) isolation of sick birds; (9) disposal of dead birds; and (10) disinfection.

Houses.—Many types of poultry houses are suitable to Hawaiian conditions. Regardless of the kind of house used, it should be free from dampness and from drafts, allow the air and the rays of the sun to enter, and be kept scrupulously clean. The long type of house is satisfactory in semitropical climates. Colony houses are desirable since they can be readily moved to clean, disease-free areas. A general cleaning and disinfecting campaign should be practiced on every poultry farm at least once a year.

Ventilation.—Mature chickens require 8,278 cubic feet of air per 1,000 pounds of body weight every 24 hours. This means that the ventilation should be adequate to supply the needs of the birds and to remove noxious gasses and excess moisture from the house. The sense of smell is a very accurate guide in determining whether the house is well ventilated. The presence of carbon dioxide in excess by 0.2 per cent over the normal amount can readily be detected by the "closeness" of the air in the house. With the open-front type of house advocated for Hawaii, the local poultryman should have little trouble in properly ventilating his poultry houses.

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[1] Italic numbers in parentheses refer to Literature Cited, pages 38-39.

Feeds.—Poultry feeds should be wholesome, palatable, and entirely free from mold. Chickens prefer fresh mash to stale mash; consequently, it is poor practice to buy large amounts of feed that must be held in storage for some time before they are fed. All feeds should be fed from sanitary equipment. (Fig. 1.)

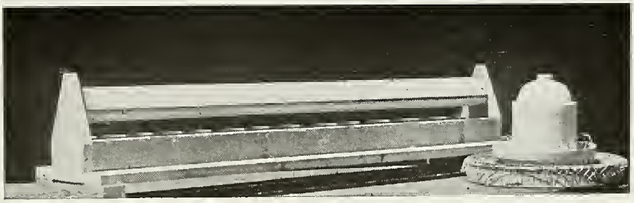


Fig. 1.—Sanitary feed trough and water fountain.

Water for Drinking.—Poultry of all kinds require plenty of water for drinking. The water should be fresh, clean, and delivered through sanitary fountains. Many harmful germs and parasites are taken into the body of the bird with the drinking water. During outbreaks of cold, pox, or bronchitis an antiseptic should be kept in the drinking water. It may be made cheaply and effectively by adding to every gallon of water two tablespoonfuls of a chlorinated lime-salt solution. Thirteen ounces of chloride of lime and one-half pound of fine table salt should be dissolved in one gallon of hot water. The chloride of lime and the salt should be mixed in a glass, earthenware, or wooden container, because the lime has a corrosive action on metal surfaces. After it has settled, the clear liquid should be poured into a similar container, stored in a dark place, and used within 10 days.

Potassium permanganate may be used in the drinking water provided the solution is changed at least three times daily. One-third teaspoonful should be used to one gallon of water. Antiseptics inhibit the growth of bacteria. They are not cures for disease. Commercial products may be purchased on the market for use as antiseptics.

Soil.—The soil is one of the principal sources of infectious diseases and of infestation with parasites. How to keep the soil free from contamination by free-flying birds, the droppings of fowls, and even from visitors, is a serious problem. On several farms in Hawaii where it is impossible to plow or to cultivate the poultry runs, the ground is likely to be badly infested with worm eggs and with larvae. A frequent rotation of yards, under intensive methods, or a change of ground from year to year, will aid in preventing disease. Lime, cultivation, and sunshine are soil purifiers.

Exercise.—It is an accepted fact that the birds should have proper exercise if they are expected to maintain good health. However, too much exercise is as bad as none at all, and is not conducive to high egg production. On the range young birds receive sufficient exercise for proper body maintenance and growth, but older birds in confinement should be made to work for their feed by taking exercise on a sun porch or by having to jump for green feed suspended in bunches above them.

Parasites.—Birds should be kept free from all kinds of parasites. The ground, the litter, and the drinking fountains may harbor internal and external parasites. Intestinal excreta are teaming with disease-producing organisms.

Isolation of Sick Birds.—Sick birds should be removed from the flock as soon as suspicious symptoms become noticeable, and placed in quarantine until known to be free from disease. They should be carefully studied to determine the kind of disease affecting them, and whether medical treatment may be advantageously given. Treating sick birds rarely pays unless they are of exceptional value, or unless flock treatment may be administered.

Disposal of Dead Birds.—All dead birds, but especially those that die from contagious disease, should be disposed of by burning. Dogs in search of food are likely to dig up a buried carcass.

Disinfection.—D. E. Salmon (*14*) says:

> Good disinfectants destroy the germs of contagious diseases, the external parasites, such as lice and mites, and in some cases the eggs of parasitic worms. The eggs of some kinds of worms are so resistant that disinfectants other than heat have little effect upon them. The disinfectants should be thoroughly applied to the interior of the houses, worked into all the cracks and crevices, spread over the ceiling and the floor, the roosts, dropping boards, and nest boxes. At the same time the feeding and drinking troughs should be disinfected by pouring boiling water into them and afterwards drying them in the sun. Disinfectants are most easily applied to the walls and ceilings with a spray pump or by using a brush. (Fig. 2.)
>
> As it is difficult to keep them from coming into contact with the face and hands, the more harmless of these mixtures should generally be used. Ordinary limewash made from freshly slaked lime is excellent, and its properties are well known to all. In the case of an actual outbreak of virulent disease it is well to add to the limewash 6 ounces of crude carbolic acid to each gallon, to increase its activity as a disinfectant.

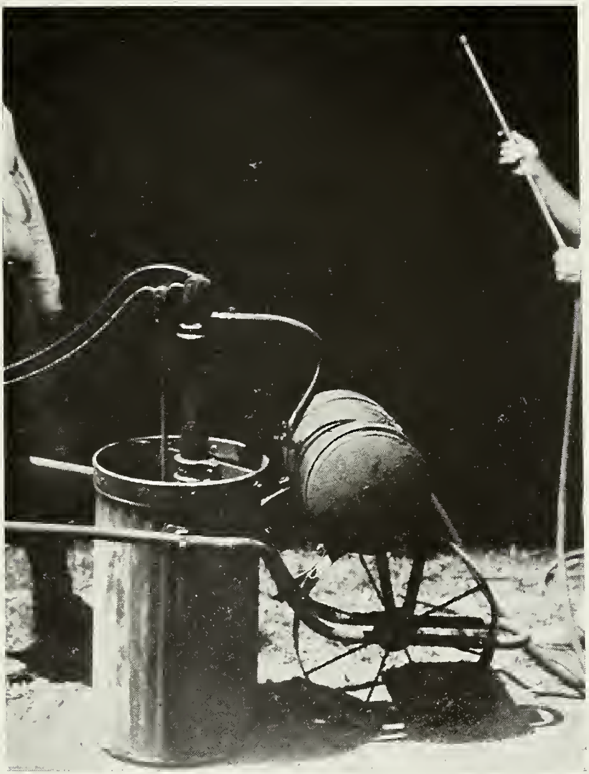


Fig. 2.—Applying a disinfectant with a pressure spray pump.

The kerosene emulsion, which is frequently used to destroy mites, may readily be converted into a disinfectant. To make the emulsion, shave half a pound of hard laundry soap into half a gallon of soft water and boil the mixture until all the soap is dissolved, then remove it to a safe distance from the fire and stir into it, at once, while still hot, 2 gallons of kerosene oil. This makes a thick creamy emulsion, or stock mixture. When it is to be used for killing mites in the house, 1 quart of this emulsion is mixed with 10 quarts of water. When it is to be used as a disinfectant, stir well, then add 1 pint crude carbolic acid or crude cresol, and again stir until all is well mixed.

The compound solution of cresol is one of the best disinfectants which may be purchased ready for use. It contains 50 per cent of cresol, and 1 pint of it added to 10 quarts of water makes a solution of the proper strength to apply to the houses or to spray over the ground. A 5 per cent solution of carbolic acid (1 pint carbolic acid to 10 quarts of water) is about equally efficacious. The choice between the two is a matter of convenience.

Heat, used in the form of live steam, boiling water, or fire, is an excellent means of destroying harmful organisms of varying resistance to the more commonly used disinfectants. A fire torch may be efficiently and economically used on non-burnable material. (Fig. 3.)

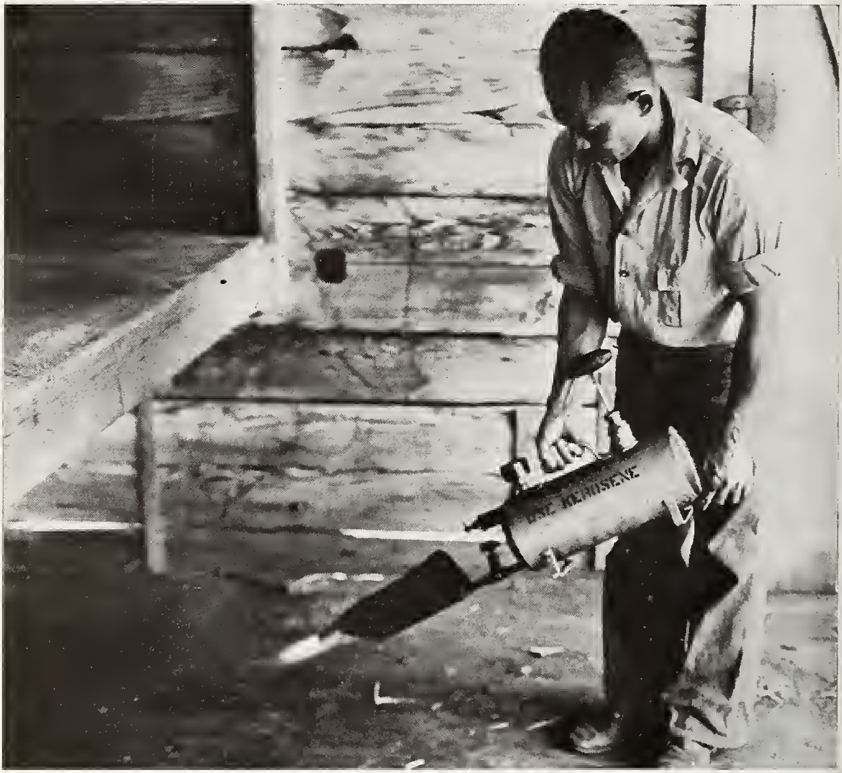


Fig. 3.—Disinfecting with a fire gun.

The floors, side walls, and all equipment should be thoroughly heated for best results. Heat is excellent for destroying coccidia and the virus causing chicken pox.

A hot lye solution (one small can of lye to 15 gallons of boiling water) may be effectively used as a disinfectant for brooder houses.

This solution should be applied to the side walls, floors, and equipment with an old broom, or with a burlap mop.

Commercial poultry sprays with a cresol base are used very extensively by poultrymen in the islands. These sprays are best applied with a pump. (Fig. 2.) Another good commercial spray carries iodine as the disinfectant. Lime is also valuable in keeping poultry quarters sanitary. (Fig. 4.)

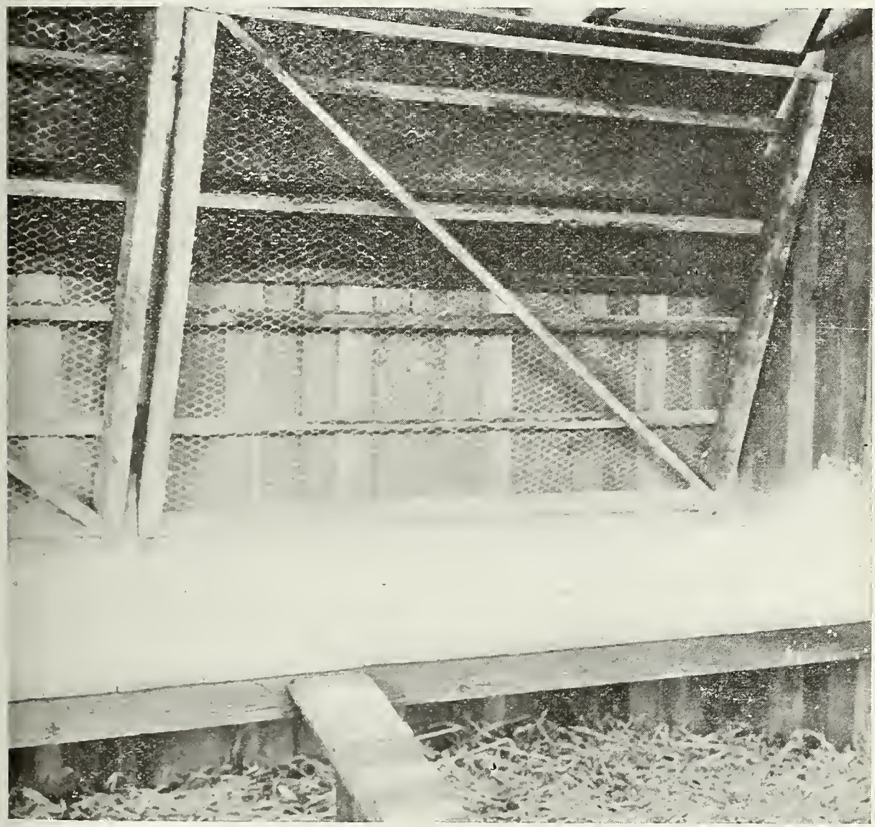


Fig. 4.—Lime is of value both as an insecticide and as a germicide.

The following information, compiled by Bushnell and Hinshaw (*4, pp. 72-74*) may prove to be of value to poultrymen in Hawaii.

To estimate the weight of a drug required to make a solution of a definite percentage multiply the weight of the solvent by the per cent desired.

TABLE OF SOLUTIONS

1 fluid ounce of water	.30 grams
To make 1 fluid ounce of a 1 to 1,000 (0.1 per cent) solution add	.03 grams
To make 1 fluid ounce of a 1 to 500 (0.2 per cent) solution add	.06 grams
To make 1 fluid ounce of a 1 to 250 (0.4 per cent) solution add	.12 grams
To make 1 fluid ounce of a 1 to 200 (0.5 per cent) solution add	.15 grams
To make 1 fluid ounce of a 1 to 100 (1 per cent) solution add	.3 grams
To make 1 fluid ounce of a 1 to 50 (2 per cent) solution add	.6 grams
To make 1 fluid ounce of a 1 to 20 (5 per cent) solution add	1.5 grams
To make 1 fluid ounce of a 1 to 10 (10 per cent) solution add	3.0 grams

To make one quart of any of the above percentage solutions, multiply the amount required for one fluid ounce by 32.

To make one gallon of any of the above percentage solutions, multiply the amount required for one fluid ounce by 128.

To make one gallon of wine-colored potassium permanganate solution add one gram (the amount which will stay on a five-cent piece conveniently).

A DISINFECTANT WASH

The following formula is one that is recommended for preparing a whitewash that has a disinfectant value in addition to its other properties:

(1) Hydrated lime	1½ pecks
(2) Salt	2 pounds
(3) Commercial lime-sulphur dip	4 gallons
(4) Water	40 gallons

Equivalent amounts for a small quantity of the above whitewash are approximately as follows:

(1) Hydrated lime	1 heaping quart
(2) Salt	3 tablespoonfuls
(3) Commercial lime-sulphur	1½ quarts
(4) Water	4 gallons

Alum added to a lime whitewash lends adhesiveness. An ounce to the gallon is sufficient. A pound of cheap bar soap dissolved in a gallon of boiling water, then added to about five gallons of boiling water, and it in turn added to about five gallons of thick whitewash will give it a gloss like oil paint. Two applications should be made each year, one each in the fall and spring. To insure penetration in cracks and crevices, the operation is preferably done with a high-pressure spray pump.

MEDICATED VASELINE

Vaseline	2 ounces
Crude carbolic acid	1 teaspoonful

Mix well before applying and use for wounds, etc.

Winter (*18, p. 69*) lists the following disinfectants and cautions regarding them:

COMMON DISINFECTANTS (BEAUDETTE 1925)

Disinfectant	Strength Used	Purpose	Cautions
Bichloride of mercury	1-1000	Soil, 1 gal. to each 10 sq. ft.	Never use on metals. Do not allow to stand a long time in wooden containers. Do not use to disinfect albuminous material. After use on soil keep fowls off run for 1 week.
Do.	1-6000	Drinking water.	Containers should be of earthenware, never metal or wood.
Silver nitrate	10 per cent solution	Mouth, nasal cavity, wounds, vent.	Never make solutions with tap water. Do not use in presence of chlorides. Not a general disinfectant.
Argyrol	10 to 15 per cent solution.	Eyes particularly, also mouth, nasal cavity.	Not a general disinfectant.
Unslaked lime	Sprinkled on soil.	Poultry runs, filthy puddles, manure.	Sprinkle with water after placing on soil. Keep fowls off runs for 1 week.
Whitewash	Slake 4 lbs. lime with 1 qt. water and dilute to proper consistency.	Interior of houses.	Use freshly prepared.
Sulphur	Burn 5 lbs. to every 1000 cu. ft. of space.	Poultry houses.	House must be tight, temp. above 60°, and sufficient moisture. Attacks metals, therefore should not be used in incubators.
Iodine	Tincture.	Wounds.	Never as a general disinfectant. Do not use on metal.
"Chlorinated lime"	20 per cent solutions.	Droppings, filthy pools, dropping boards. Wash drinking vessels. Good deodorant.	Not often used as a general disinfectant.
Liquor cresolis and crude carbolic acid	2 to 5 per cent solution.	Interior of poultry houses. Incubators.	

Disinfectant	Strength Used	Purpose	Cautions
Carbolic acid	5 per cent.	Washing drinking vessels, wounds.	Too costly for general disinfectant.
Do.	1-1000	Drinking water.	
Potassium permanganate	1-500 to 1-1000.	Drinking water. Wounds.	Never used as a general disinfectant.
Formaldehyde	5 per cent.	Interior of houses, coops, etc. Incubators.	Irritating to mucous membranes. Hardens the skin.
Formaldehyde gas	1½ lbs. potassium permanganate, 3 pts. formaldehyde, 1000 cu. ft.	Poultry houses.	Tight house, temperature 60° or above. Sufficient moisture.

SIMPLE CATARRH (COLDS)

Simple catarrh (colds) is a mild inflammation of the nasal membranes and should be promptly checked.

Cause.—Keeping the birds in houses that are drafty, damp, dirty, or over-crowded, and exposure in the open to unfavorable weather conditions, including rains and moisture-laden winds, lowers the vitality of the birds and predisposes them to colds.

Symptoms.—The symptoms are a watery discharge from the nostrils and the eyes of the affected fowls, which may become of viscid consistency, the adherence of straw and feathers to the beak and to the nostrils, the appearance of soiled feathers over the shoulders against which the head has been rubbed (Fig. 5), heavy mouth

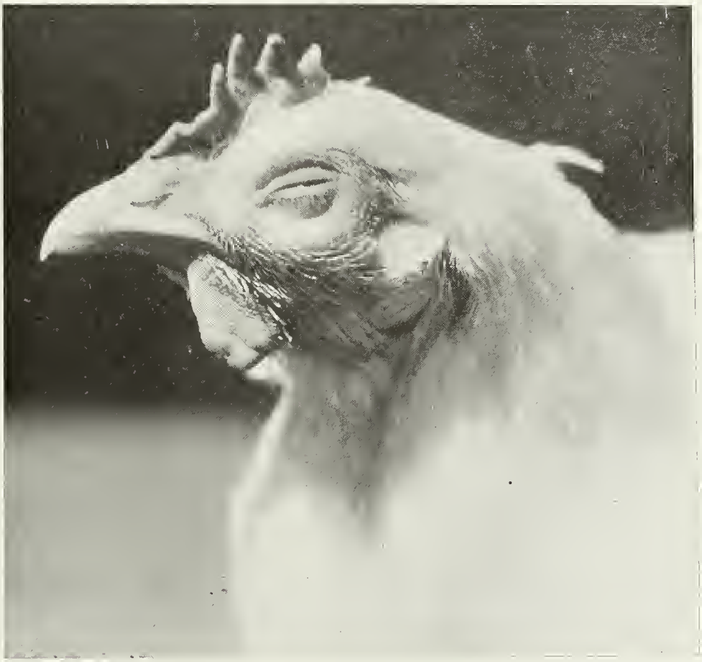


Fig. 5.—Head of fowl affected with cold and roup. Note the swollen eye.

breathing, and some sneezing and wheezing. The birds huddle in corners instead of ranging with the flock. Colds usually are accompanied by loss of appetite and, in the case of laying hens, by diminished egg production.

Treatment.—Colds usually are of short duration and may be controlled by washing out the nasal passages twice daily with boric acid in 3 per cent solution, or with potassium permanganate (1 teaspoonful to a pint of water) (*7, p. 2*). See treatment for contagious catarrh if colds are severe.

CONTAGIOUS CATARRH (ROUP)

Contagious catarrh (roup) attacks the membranes lining the eye and the sacs below the eye, the windpipe, and the nasal openings.

Cause.—Contagious catarrh or roup is caused by an organism the nature of which is not known. The contagion may be brought into the poultry yards by infected birds.

Symptoms.—The symptoms of roup are similar to those of simple catarrh. They are more serious, however, and usually persist for some time. The nasal discharge is thick and has an offensive odor. The inflammation spreads from the nasal passages to the eyes, causing the lids to swell. They remain much of the time glued together by the accumulated mucous or pus-like matter. The affected bird has great difficulty in breathing.

Another form of roup (diphtheria) is associated with the appearance of white spots in the throat and the mouth. These spots, minute at first, increase in size as the disease progresses, eventually lining the walls of the throat. In some instances yellowish cheesy masses in the throat cause the affected bird to breathe through the mouth. In severe cases the bird suffocates.

Treatment.—The best treatment lies in removal of the cause. Insanitary conditions should be corrected at once if the birds are expected to recover in a short time. Birds suffering from roup should be treated individually when the eyelids are swollen, and the eyes, clefts, and nostrils should be massaged to press out the accumulated secretion. Boric acid (1 ounce to 1 quart of water) (*7, p. 3,*) should be dropped directly into the eye. One or two drops of a 10 per cent solution of argyrol should be introduced between the eyelids and into the clefts and nostrils; or the fowls may be treated by applying a dilute solution of iodine (equal parts of iodine and water) to the affected mucous membranes of the nostrils and the mouth. A suitable antiseptic should be kept in the drinking water until the trouble disappears.

If the sacs below the eyes (sinuses) are swollen they should be carefully opened with a clean, sharp knife. The cheesy matter should be gently forced out and the cavity washed with a 10 per cent solution of argyrol or with a dilute solution of iodine. If both sinuses are affected only one should be cut at a time, and the bird should be rested for a day or two between operations.

For flock treatment Epsom salts at the rate of one pound for every 100 birds should be dissolved in one-half the usual amount of water they would consume. For best results the birds should have access to fresh water after two hours' time. Once a day they should be fed a wet mash and Cayenne pepper mixture (1 cup of pepper to 12 quarts of wet mash). Each bird's head may be plunged once a day into a pail of a warm water solution of a diluted chlorine mixture.

Prevention.—Sanitary conditions should be maintained at all times, and a good antiseptic should be kept in the drinking water during the rainy period. Overcrowding, especially on the roosts at night, should be avoided. Proper ventilation should be provided, drafts eliminated, and the litter kept dry. Poultry houses should never be built on low, damp ground, or where moisture-laden winds can blow directly into the houses. The birds should be given a balanced ration. All new birds from other farms should be held in quarantine until it is certain that the flock is free from disease.

INFECTIOUS BRONCHITIS

Infectious bronchitis or "flu" (*1, p. 570; 8, p. 3*) is a disease characterized by inflammation of the trachea or windpipe.

Cause.—According to Gallagher (*7, p. 6*) "the disease is caused by the presence of an infective agent the nature of which is not known."

Symptoms.—The disease is characterized by rapidity of spread and by difficult breathing (*12, p. 20*). The birds gasp for breath, and extend the head and the neck as if trying to clear the throat (Fig. 6), open the beak for intake of air, and wheeze loudly. Birds shipped in

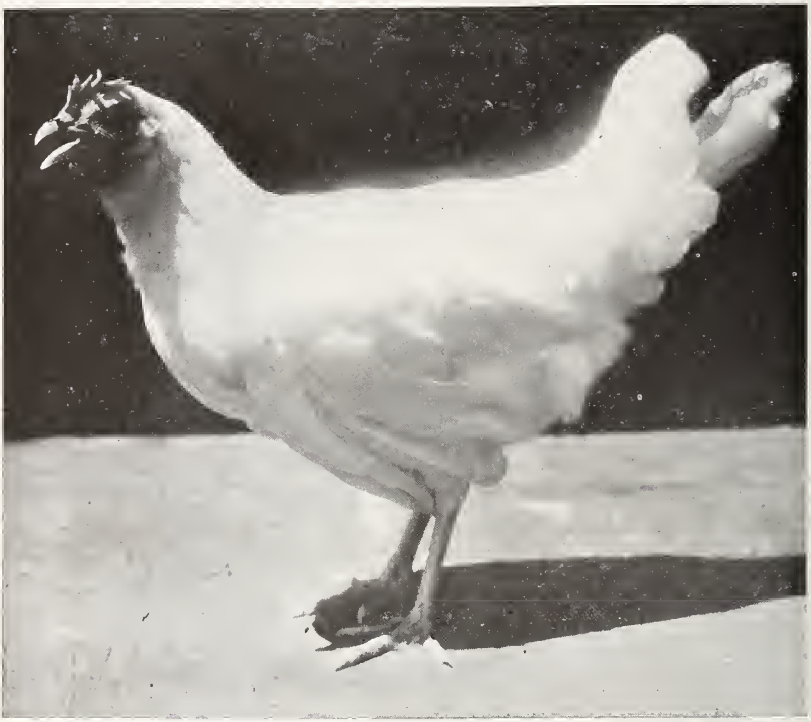


Fig. 6.—A young pullet affected with infectious bronchitis. Wings drooped, and mouth open for breath.

from the mainland were commonly found to be suffering from infectious bronchitis and died shortly after their arrival. Affected birds discharge mucous and blood from the throat, and in some cases water from the eyes and the nostrils. The birds are drowsy and may remain on the roosts or huddle in corners on the floor. The mortality in Hawaii has ranged from 10 to 50 per cent of all the birds in the flock, and in some outbreaks the entire flock has died.

Treatment.—Sick birds should be separated from the rest of the flock as soon as they are detected. An antiseptic should be placed in the drinking water to suppress the spread of the disease through this source. The birds should be confined in warm quarters which can be flooded with sunshine. The entire head of the affected birds should be dipped in a warm chlorine solution (equal parts chlorine solution and water). This treatment should be given once daily until the birds show improvement. During the period of treatment the birds should be given a mixture made of one cup of Cayenne pepper to every 12 quarts of wet mash. At night a healing vapor should be sprayed over the heads of the birds. Giving close attention to the comfort of the birds will greatly aid in overcoming the disease.

Prevention.—All birds brought in either from the mainland or from local farms should be quarantined. Visitors should not be allowed in the poultry house and runs. Strict sanitation in all farm operations should be adhered to, the houses, feed hoppers, drinking fountains, and runs being frequently cleaned.

FOWL CHOLERA

Fowl cholera is an infectious disease and is marked by rapid spread through a flock and by high mortality (*13*).

Cause.—This disease is caused by *Pasteurella cholerae gallinarum* (or *P. avicida*) which produces blood poisoning. The time between exposure to contagion and appearance of symptoms is from two to five days, and the duration of the disease is from 24 hours to 10 days.

Symptoms.—A yellowish coloration of the droppings is first noticed, and is followed by yellowish, brownish, or greenish diarrhea. The droppings may contain mucous. There is considerable fever, and soon the bird becomes dull and sleepy. The plumage loses its brilliance, the wings droop, the appetite is diminished, and the thirst increased. The comb and the wattle may be dark-bluish red from engorgement of poorly oxygenated blood or may be pale and bloodless, due to congestion of the internal organs, especially the liver. Sleepiness is one of the characteristics of cholera, especially so during the last day or so before death. In the cute form of cholera death occurs shortly after the fowl is attacked and is not preceded by symptoms of the disease. It differs from the chronic form which is characterized by lingering of the disease, and by continually increasing weakness.

Treatment.—No treatment for the cure of cholera may be relied upon. All healthy birds should be separated from affected ones and the houses and equipment should be thoroughly disinfected with compound solution of cresol in 3 per cent solution(*7 p.11*). The first birds showing symptoms of the disease should be killed and the carcasses burned. A good antiseptic should be placed in the drinking water to check the spread of the disease through this source. The birds should be given a dose of Epsom salts and then placed on a 40 per cent milk mash for 10 days after which they should receive another dose of the salts.

Prevention.—Rigid sanitation should be adhered to. New birds from the mainland should be placed in quarantine. Visitors should not be allowed on runs or in the laying houses.

LEUKEMIA

Leukemia is a serious disease in Hawaii.

Cause.—Leukemia is probably caused by a microscopic virus.

Symptoms.—Pale wattles and combs are assocated with this disease. In advanced stages of the disease, the birds gasp for breath. The birds may maintain their normal weight, and, in the case of heavy producers, may continue to lay up until the last day. Chronic leukemia may be characterized by a greenish diarrhea. Acute leukemia is seldom accompanied by diarrhea. Post-mortem examination reveals enlargement of the liver and surface spotting. In acute leukemia the liver appears to be dark in color and irregular in form. Spotted areas may also be found on the spleen, which is much enlarged and congested.

Treatment.—No reliable remedy for this disease is known. Durant (*5, p. 8*), working with poultry, found that raw liver when fed to some affected birds gave apparently pronounced curative results.

Prevention.—Strict sanitation and hygiene should be adhered to. Weak and sickly birds should be removed from the flock. A good antiseptic should be kept in the drinking water so as to check the spread of the disease through this source. A good solution may be made by placing one ounce of copper sulphate in each 8 gallons of water.

BACILLARY WHITE DIARRHEA OF CHICKS (PULLORUM DISEASE)

White diarrhea is a highly acute and fatal infectious disease of chicks (*18, p. 409; p. 631; 16*).

Cause.—White diarrhea of chicks is caused by a microorganism (*Bacterium pullorum*). The organism is usually found in the ovary (egg cluster) of the hen and is transmitted to the chick through the egg. On the eighteenth or the nineteenth day of incubation the chick takes into its body the residue of the egg, and thus the organisms are carried to the intestines where they multiply rapidly.

Symptoms.—Characteristic symptoms of the disease appear within four to ten days. The chicks huddle together or remain under the brooder or the hen longer than they should. They are short-bodied and appear to be listless, and stand or sit still with the eyes closed and the wings drooped. (Fig. 7.) The whitish diarrhea soon appears. Towards the last stage of the disease the chicks lose their strength and, becoming too weak to stand, fall on their sides or backs and die.

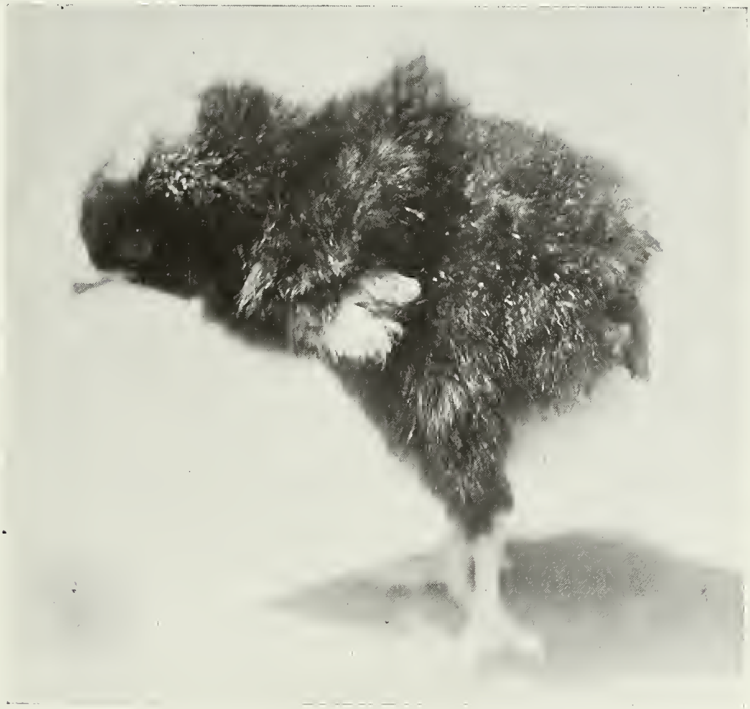


Fig. 7.—A chick four days old affected with bacillary white diarrhea.

The disease kills thousands of chicks every year on the mainland and in Hawaii. A whole flock of chicks may become affected and die.

Treatment.—Medical treatment is impracticable. The poultryman, therefore, should aim to keep his flock free from the disease.

Prevention.—Bacillary white diarrhea may be prevented by (1) incubation, (2) by proper feeding, (3) by the employment of sanitary measures, and (4) by the use of the agglutination test.

Three advantages may be gained by darkening the incubator on the eighteenth day: (1) The chicks remain where they hatch and are well scattered on the tray instead of moving toward the light, as is the case when the machine is not darkened; (2) they sleep and build up resistance to infection; and (3) they can not pick at one another's droppings and thus infect themselves through the digestive tract (*3, p. 3*). Baby chicks should never be permitted to fall to the nursery tray. On the hatching tray the temperature registers 103½° F. The chick is wet when hatched; consequently, if it falls to the nursery tray it may be chilled, in which case its resistance to disease will be lowered. The bacillary white diarrhea microorganism finds such chicks favorable hosts upon which to work.

The chicks should be given milk to drink to strengthen them against disease. A well-balanced ration containing milk in some form should be fed, beginning when the chicks are 36 to 48 hours old.

The incubator should be thoroughly cleaned and sprayed after each lot of chicks has hatched. The brooder house should be thoroughly cleaned with a hot lye solution and given a coal tar spray before the chicks are placed. The litter should be frequently changed in order that the healthy chicks may not eat the droppings of the infected ones. All feed should be fed from troughs that are cleaned and sprayed frequently. Drinking fountains so constructed as to prevent the birds from polluting the water with their droppings should be provided for the birds.

Samples of blood should be taken from hens to be used as breeders to determine whether they carry the organism. Those showing a positive reaction to the agglutination test may be omitted from the breeding flock. The blood test should be made by a veterinarian or by a bacteriologist.

SOREHEAD (FOWL POX)

Sorehead (*fowl pox*), identified as *Epithelioma contagiosum,* is one of the most serious diseases of growing stock (*10, p. 5*) and baby chicks in Hawaii.

Cause.—Sorehead is thought to be caused by a filterable virus.

Symptoms.—The disease manifests itself in the wart-like eruptions that appear on the comb, the wattles, and other parts of the head of the affected fowl. (Fig. 8.) The eruptions are first soft and yellowish, but later develop into hard, brown crusts. Canker patches in the mouth, at the opening of the trachea, underneath the tongue,

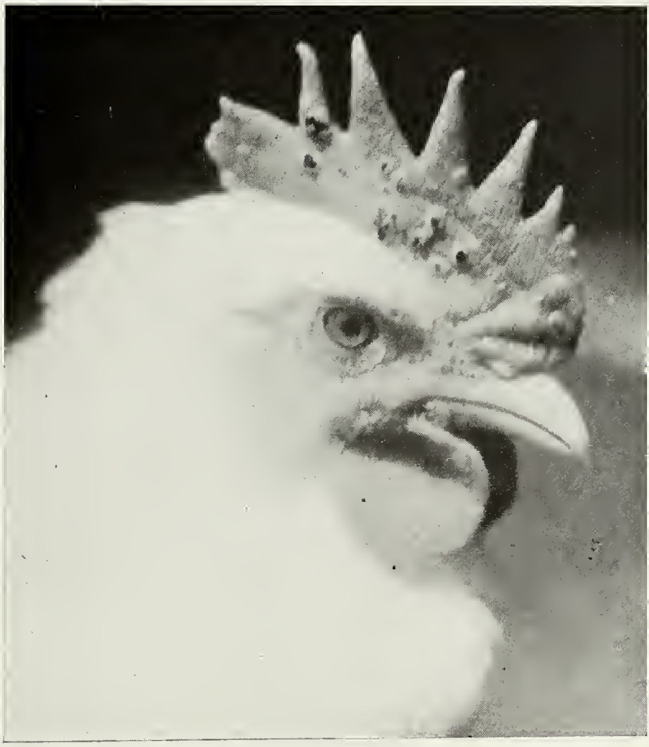


Fig. 8.—Wartlike eruptions on the comb of a young cockerel affected with fowl pox.

and on the lining of the throat, are associated with sorehead. Suffocation follows when masses of yellow exudate collect in the trachea. In severe cases cheesy matter is eliminated from the eye, the nostrils, and the throat. When both eyes are affected the bird may eventually become blind.

Treatment.—Infected birds should be removed from the flock and given individual treatment. Carbolated vaseline should be applied to the crusts when they are in the soft, yellowish stage. Hard crusts should be removed by washing with warm water, and the denuded tissues should be treated with tincture of iodine. The crusts should never be removed more often than once from the same nodule. The canker areas or false membranes should be gently removed with a forceps and the diseased surface treated with iodine. The throat should be swabbed with iodine. The eyes should be treated with a dilute solution of iodine, or with a chlorine solution. The mucous or pus-like matter should be pressed from the eye, and either a boric-acid solution or two or three drops of a ten per cent solution of argyrol should be used to wash each eye, or injected into the nostrils and the cleft. For best results this treatment should be given daily. The drinking water should be made antiseptic.

Prevention.—Precautions to prevent the disease are more successful than is any attempt to cure it. At this station a series of experiments have just been completed to determine the best method for controlling sorehead (*3, p. 6*). The experiment shows that infection can be materially lessened and finally controlled by eliminating the day and night mosquitos. Overcrowding shoud be avoided, as it lowers the power to resist disease.

Several trials are under way at the station to determine the value of vaccination as an immunizing agent against the disease. The results to date are favorable. Complete results of the work are to be published in a separate circular.

COCCIDIOSIS

Chicks from two to eight weeks old are susceptible to coccidiosis.

Cause.—Coccidiosis is a disease of the intestines and is caused by a protozoan organism known as *Eimeria* (*Coccidium*) *avium.* The disease attacks primarily the ceca or the blind gut, and causes these organs to become inflamed. The disease enters the body of the chick through the digestive tract. The coccidea multiply rapidly and great numbers are discharged with the droppings.

Symptoms.—The first symptoms of coccidiosis are drooping wings, listlessness, continuous peeping, bloody droppings, and inability to keep pace with the healthy birds. Usually a large number of the chicks show the same symptoms at the same time, and a high percentage of them may die within a day or two after the disease is noticed. In acute cases the deaths become less frequent each day during the first week. In chronic cases the affected birds should be killed and the carcasses burned. (Fig. 9.)

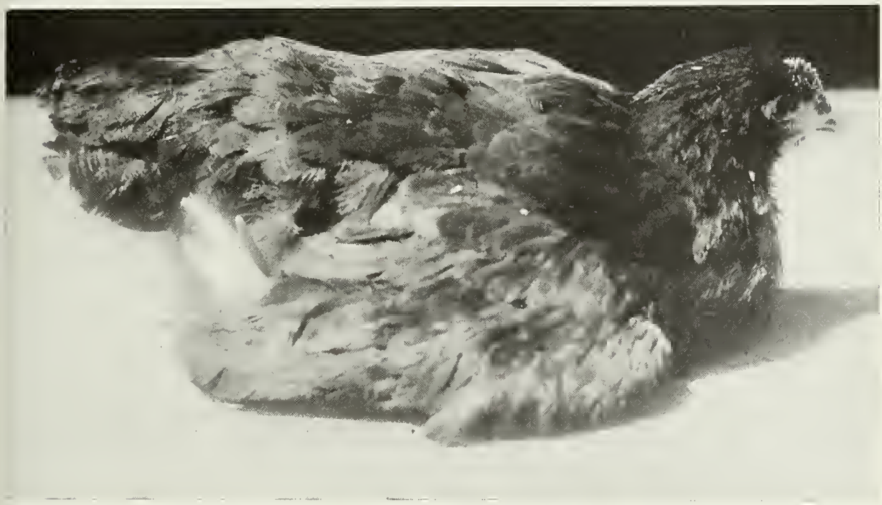


Fig. 9.—Coccidiosis in a young pullet at 8 weeks.

Treatment.—Every precaution should be taken to safeguard the flock from coccidiosis (*3, p. 4*). Although the disease is difficult to control, certain remedies may be successfully used to check its spread. Birds two to eight weeks of age should be given one-quarter of a pound of Epsom salts in four gallons of drinking water for every one hundred chicks as soon as the disease is detected. Dried skim milk or buttermilk should be fed from the first day of the disease as 40 per cent of the ration, and as the chicks improve, gradually decreased to 15 per cent if milk is not present in the regular mash. If milk is present in the regular mash, no additional milk is required after ten days.

Prevention.—All rules of poultry sanitation should be obeyed for control and prevention of the disease (*11, p. 11*). The chicks should not be allowed to become overcrowded, overheated, or chilled. Sparrows and mynah birds, as well as human visitors, should be excluded from the brooder house and the runs. The chicks should be fed a plentiful supply of a well-balanced ration to increase their power of resistance to disease. Chicks from infested flocks should not be purchased, and should never be placed in the same brooder house with healthy chicks. All old litter should be removed and burned. No litter should be purchased from infested localities. Twice daily, if possible, the brooder house should be washed thoroughly, the floor and the sides being cleansed with a hot solution of lye water. After all the mechanical cleaning has been done, the house should be sprayed with a 10 per cent creolin solution. A fire torch may be used on non-burnable material. After the house has thoroughly dried, the floor should be covered with dry, clean litter. All feed hoppers, drinking fountains, and brooders should be cleansed in the same manner as is the house. The house should be moved to clean ground where no chicks of any age have run previously, and the yards should be rotated, the deserted one being plowed and limed when possible.

ASPERGILLOSIS (BROODER PNEUMONIA)

Aspergillosis or brooder pneumonia is a fungus disease of the lungs which may attack any of the domestic birds, and especially chicks.

Cause.—The disease is caused by the common green mold (*Aspergillus fumigatus*). This mold very commonly attacks hays and grains that are stored in damp places. It appears on damp feed in green or brown patches that give off numerous spores. When such material is fed or used as litter, the birds inhale the spores of the fungus. Crowding the chicks in small, poorly ventilated brooder houses favors the entrance of the spores into their respiratory organs.

Symptoms.—The symptoms of aspergillosis are loss of appetite, diarrhea, accelerated breathing, a rattling or croupy sound in the throat, drooping wings, a tendency to sleep, and fever. Post-mortem examination reveals the growth of mold on the linings of the trachea and in the bronchial tubes. These organs are often greatly congested with blood and with mucous. Grey canker patches may or may not be present in the lung tissue.

Treatment.—Aspergillosis is difficult to cure because of the inaccessibility of the area affected. The following treatment may give beneficial results: Two tablespoonfuls of either coal tar or turpentine should be placed in a quart of hot water and the mixture let stand for 1½ hours. This mixture should be poured on hot bricks in the brooder house, or in any small room in which the chicks are shut up, until the room is filled with the vapor. The inhalation by the birds of coal tar or of turpentine aids in destroying the mold in their lungs and trachea, decreases the difficulty of breathing, and permits increased amounts of oxygen to be carried to the lungs, thus overcoming the tendency of the bird to suffocate.

Prevention.—The brooder house should be kept dry and well ventilated, and proper temperature conditions should be constantly maintained. Crowding or huddling of the birds in the corners of the house or underneath the brooder indicates improper temperature. Only clean, dry litter, free from mold and from dust, should be placed in the brooder house. The birds should receive clean grain in clean troughs. The house should be kept clean and be disinfected frequently, especially the floors. Infected chicks should be isolated from the flock just as soon as they are discovered. Carcasses should be burned.

PROLAPSE OF OVIDUCT

Prolapse of the oviduct follows "egg bound" conditions (*4, p. 67*).

Cause.—Attempts to pass too large or double-yolked eggs may cause the oviduct to become highly congested. Young birds especially are likely to suffer from such inflammation and to pass misshapen eggs. Fatness in old hens may cause the oviduct to protrude through the vent.

Symptoms.—The oviduct and cloaca are everted through the vent. The appearance of blood on the organs may encourage other birds to pick at the prolapsed parts.

Treatment.—The affected birds should be isolated, and the oviduct and the cloaca should be thoroughly greased with sweet oil and examined. A retained egg should be punctured and removed in parts either with a forceps or with the forefinger. The inflamed parts should be again oiled and the organs gently pushed back into the body. The cloaca should be flushed with cold water to relieve congestion and to cause the walls to contract. Some birds require several treatments before they are cured.

Prevention.—The pullets should receive a ration that will help to retard sexual maturity until they have otherwise fully matured.

BUMBLEFOOT

Bumblefoot is frequently found in the heavier breeds, but may attack all kinds of domestic fowls.

Cause.—Bumblefoot is caused by bruises resulting from jumping from high roosts to cement floors, or it may be caused by continuous walking on cement floors that are free from litter, or by roosting on narrow or round perches and ranging on rocky runs.

Symptoms.—Lameness is the first indication of bumblefoot. An examination of the ball of the feet reveals swollen areas that are filled with pus. If the swelling is not lanced the cheesy matter forms into hard lumps. In some cases an abscess with a core-like center forms in the pad or between the toes, although more frequently only a swelling occurs (Fig. 10).

Treatment.—The swollen areas should be lanced with a sharp knife, the contents removed, and the cavities washed with carbolized water. The feet should be bandaged to keep out the dirt, and the wounds painted with tincture of iodine for several days. If recovery is slow the bird should be marketed unless it has some special merit.

Prevention.—Plenty of litter should be kept on the floor, and the roosts placed near the floor. The roosts should be wide and planed on the roosting side. No roosts should be made from limbs of trees. All rocks should be removed from the runs.

LIMBERNECK (BOTULISM)

The condition known as limberneck is a symptom of disease and may attack a large number of birds in a flock in a short time. It may appear overnight.

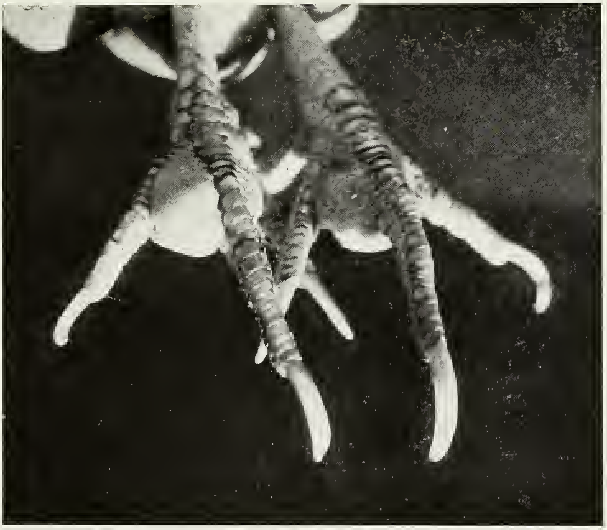


Fig. 10.—Bumblefoot. Note the large swollen areas between the toes.

Cause.—Limberneck is usually caused by the feeding of spoiled stuffs containing the toxins of a spore-forming organism (*Clostridium botulinum*). The organism may be found in decaying vegetables and spoiled grains, in putrified meat, and in spoiled canned goods.

Symptoms.—In mild cases paralysis of the muscles of the legs or of the wings is characteristic. In severe cases the neck muscles are so completely relaxed as to make it impossible for the bird to raise its head from the floor. During the latter stage the bird remains on the floor in a limp condition.

Treatment.—Treatment is seldom satisfactory. Sick birds should be given two teaspoonfuls of castor oil or two-thirds of a teaspoonful of Epsom salts. For flock treatment, one pound of Epsom salts may be given to every one hundred birds. The sick birds should be removed from the flock, and all carcasses should be burned. Litter and droppings should be either burned or carried to a place beyond the reach of the poultry.

Prevention.—The birds should be fed only clean, wholesome rations. The soil should be kept well-drained and free from harmful bacteria. Fly maggots bred in soils containing such a poison-producing organism are highly poisonous to poultry eating them.

CANNIBALISM

Cause.—Cannibalism may be due to crowding the chicks in small houses or in small brooder runs, or to injury, sufficient to draw blood, to their shanks and their toes. Cannibalism may start about the third week, the chicks being attracted to the blue veins that show through the skin. Dead chicks in the brooder house or on runs may be the cause of cannibalism in a group of chicks.

Symptoms.—Several chicks may peck at one another's toes or tail and thus cause the blood to appear (Fig. 11). The habit is strengthened once the chick gets the taste of blood. This vicious practice is imitated by other chicks in the flock and may cause the death of many weaklings. Sometimes an entire carcass is devoured by the attacking chicks.

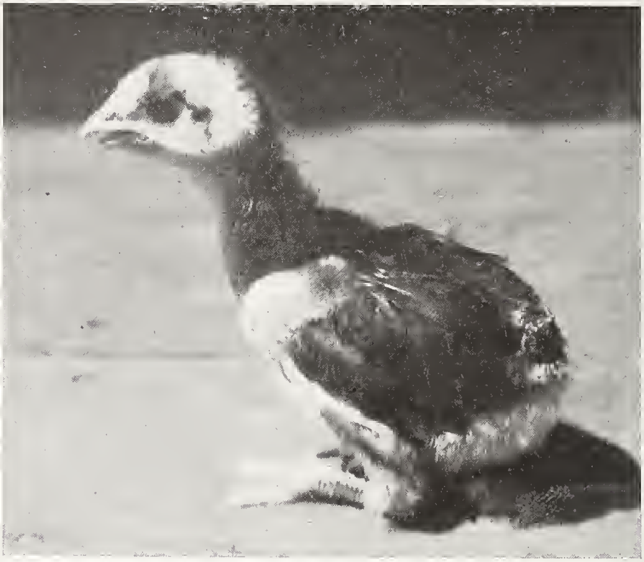


Fig. 11.—A chick with its tail picked off by other chicks. Cannibalism is common in chicks closely confined.

Treatment.—Crude oil or iodine should be applied to the affected parts of the chick, and in severe cases the injured fowls should be removed to another house. Commercial preparations may also be used.

Prevention.—Chicks should not be crowded in small well-lighted rooms. As soon as they are detected all dead chicks should be removed. The chicks should be given plenty of exercise and should be kept supplied with plenty of feed. They should be given a well-balanced ration. The windows in the brooder house should be darkened and the room should receive only sufficient light to enable the chicks to find their food.

MANSON'S EYEWORM

Manson's eyeworm (*Oxyspirura mansoni*) is a parasitic nematode found beneath the nictitating membrane of the eyes of poultry (*15, p. 583*). The worms live in the inner corner of the eyes and have a definite life cycle. The eggs are found in damp soil where they hatch. The larval eyeworm reaches the eye of birds that dust themselves in infested soil, and when mature may vary from one-fourth of an inch to one inch in length. The adult while in the eye lays numerous eggs that are immediately washed down through the tear duct into the intestines of the birds. These eggs pass out of the body of the birds with the droppings and begin a new life cycle in the soil. The cockroach is the intermediate host of the eyeworm.

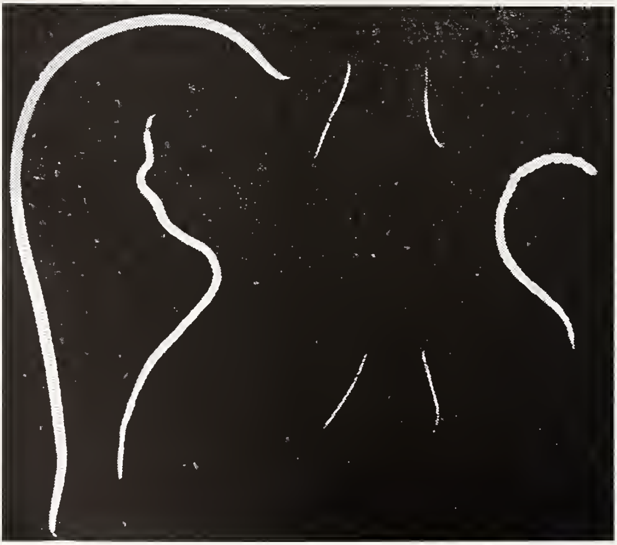
Symptoms.—The eyes of the birds appear to be watery and are occasionally scratched with the foot. Severely infested birds become blind. The feathers are wet and dirty over the shoulders where the birds have rubbed their heads in an effort to relieve the eyes.

Treatment.—Affected birds demand individual treatment. The worms may be forced from the nictitating membrane, also known as the winking membrane, on to the eyeball by a firm pressure of the tip of the index finger over the tear duct toward the eyeball. The nictitating membrane should be lifted and a few drops of a two per cent solution of creolin should be sprayed directly into the corners of the eyes. They should be immediately irrigated with clean water and treated with a drop of ten per cent argyrol.

Prevention.—The poultry houses should be kept thoroughly clean and disinfected. The yards should be limed, cultivated if possible, and planted with an early-maturing green crop. The chickens should be changed from one yard to another as often as possible. Cockroaches should be exterminated from the houses and the runs.

ROUNDWORMS

Poultry is infested with two species of roundworms, the small, round white cecum worm, or heterakid (*Heterakis gallinae*), which varies from three-tenths to one-half of an inch in length; and the large, white or yellowish roundworm (*Ascaridia lineata*), which varies from one-half of an inch to four inches when fully grown (Fig. 12). Roundworms deposit in the intestines of the birds eggs which are passed to the ground with the droppings. Under favorable conditions of temperature and moisture the small roundworm eggs will promptly hatch if picked up by birds.



(Fig. 12.—Roundworms at the left, pinworms in the center, and a tapeworm at the extreme right. (After L. M. Hurd.)

Symptoms.—The birds appear to be thin, unthrifty, with wings drooped, and head and shanks pale. Diarrhea or constipation may be present.

Treatment.—The birds should be fasted from 12 to 24 hours before they are given any worm remedy. After they have been fasted the birds should be fed a mash in which Epsom salts at the rate of one pound per 100 birds has been mixed. Twelve hours later the birds should be given another dose of Epsom salts. If the birds are severely infested with roundworms, a second treatment should be given a week later.

The California Agricultural Experiment Station recommends the following treatment *(2, p. 69)*:

Mix 6.6 cubic centimeters (7.92 grams) of nicotine sulphate (Black-Leaf-40) with 16 grams of Lloyd's Alkaloidal Reagent (a special Fuller's earth). The powder when thoroughly mixed is packed in No. 2 gelatine capsules in quantities to weigh, when filled, from 350 to 400 milligrams. Give one capsule to a bird. Care should be taken to work the capsule well down into the crop. For badly emaciated birds from one-half to one-fourth of the powder should be removed from the capsule before administering. These capsules may be obtained from any local druggist. The worms are eliminated in approximately 48 hours, after which the houses and the pens should be thoroughly cleaned to prevent reinfestation from worm eggs already present.

Another remedy recommended for roundworms is the use of rectal injections of oil of chenopodium (oil of American wormseed). The mixture is made up at the rate of one tablespoonful of oil of chenopodium in 6 fluid ounces of cottonseed oil. It is given preferably with the infant's-size syringe at the rate of one teaspoonful for a half-grown chick, and one tablespoonful for an adult bird.

Commercial preparations may also be used with good results.

Prevention.—The runs should be kept as clean and as dry as possible. Puddles of stagnant water should be drained and the droppings should be removed regularly. The birds should be allowed plenty of free range because they will then be less likely to become infested, all other things being equal, than those on a limited range. Worm medicine should be given at regular intervals to the birds.

TAPEWORMS

Tapeworms are flat, and segmented, and attach themselves to the lining of the intestines by a head or scolex (Fig. 12). Three common species are found in poultry. *Davainea proglottina* is of microscopic size, the longest specimen being not over one-sixteenth of an inch in length. This species is found in the lining membrane of the intestinal tract. *D. echinobothrida,* a larger species, burrows into the wall of the intestine and produces small nodules closely resembling those caused by tuberculosis. *Choanotaenia infundibulum* is the largest of the three species, often being a foot long. It may be found in any part of the intestinal tract. One or all of the species may be present in the same bird at the same time.

Tapeworms require an intermediate host for development. The eggs are eaten by small invertebrate animals, such as insects, snails and earthworms, and hatch in them. When the infested host is eaten by the chicken the larval tapeworm rapidly develops to the adult stage in the intestines.

Symptoms.—Birds infested with tapeworms show signs of nervousness in the form of wry neck, loss of equilibrium, lameness, loss of flesh, thickening of the intestinal wall, and inflammation of the lining of the intestines.

Treatment.—Kamala is very effective for removing tapeworms from chickens. It is a brownish-red powder produced from an evergreen shrub grown in Australia, certain parts of Africa, the East Indies, and in tropical Asia. At the University of Wisconsin kamala gave nearly one hundred per cent satisfactory results in controlled tests made by B. A. Beach and by D. M. Warren.

Two methods are now in use, individual treatment and flock treatment. In individual treatment each affected bird is given kamala in one-half gram capsules, the dose varying with the weight of the bird. Birds weighing ½ to 1 pound are given ½ gram of kamala; those weighing 1 to 2 pounds, 1 gram; and those weighing 2 pounds or more, 1½ grams. The capsules are easily administered if they are moistened with water or with oil and then placed well down the bird's throat. It is not necessary to give Epsom salts following treatment, because kamala has a laxative effect. In flock treatment the birds should be grouped according to weight and fasted for 18 to 24 hours for best results. Birds weighing ½ to 1 pound should receive ¾ of a gram of kamala; those weighing 1 to 3 pounds, 1 gram; and those weighing 3 pounds or more, 2 grams. The proper proportion of kamala should be mixed with one-third as much corn meal as the flock usually consumes at a feeding, and placed in troughs.

Commercial preparations may also be used effectively.

Prevention.—The droppings should be frequently removed to some distance from the areas so that the birds can not eat the worm eggs passed in it. Chicks should be kept off ground that has been used by infested hens. The poultry runs should be plowed, cultivated, and planted with a green crop, and the birds should be given plenty of range.

LICE

Lice attacking birds are named after the part of the body they infest, for example, neck lice, head lice, tail lice, shaft lice, feather lice, wing lice, and body lice. These species are found on chickens in the United States and belong to a group known as the mallophagan biting lice. They have three pairs of legs and a body that is divided into three parts, head, thorax, and abdomen. These lice are seldom over three-sixteenths of an inch long. They are yellow or grayish, striped with irregular dark brown or red. Each species has a flattened body, sharp-clawed feet, and a large head, but neither eyes nor wings. They differ from one another only in their habits of attacking birds (Fig. 13).

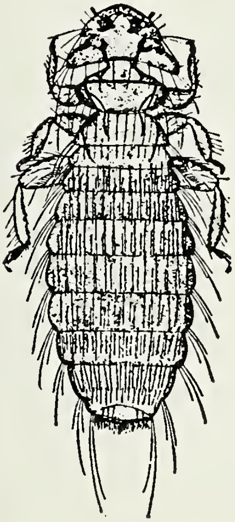


Fig. 13.—A chicken louse, greatly enlarged.

The entire life cycle of these lice is spent on the body of the bird. Lice undergo three distinct life stages, the egg, the nymph, and the adult. The eggs are laid on a feather close to the skin of the bird. The eggs hatch within four to seven days and the young lice somewhat resemble the adult lice. Before reaching the adult stage they molt several times and increase in size. The complete life cycle lasts two to three weeks.

Symptoms.—Birds infested with lice are nervous and inclined to have ragged feathers, to droop, and to be low in vitality; consequently, egg production is lowered in such birds.

Treatment.—Sodium fluoride seems to be the best remedy for lice. It may be applied in two ways. The dip method may be satisfactorily used on warm days. One ounce of the commercial sodium fluoride should be used in each gallon of water. One pound of sodium fluoride is enough to meet the requirements of three hundred birds. The bird should be held by the wings with one hand, then plunged into a tub full of the solution. The other hand should be employed in working the liquid well into the feathers and about the body. The head should be ducked once or twice after the rest of the body has been thoroughly washed. After the excess water has been allowed to drain from the feathers, the bird should be placed in the sun to dry. This treatment should be repeated within a few weeks to kill any eggs that may have hatched in the meantime.

In the "pinch" method the sodium fluoride is placed in small pinches on the underside of each wing, at the base of the neck, in the fluff, and on the head and on the breast. If a large number of birds are to be treated the poultryman should protect his eyes and his nostrils in order that they may not be irritated by the powder. The powder should be worked well into the feathers.

Applications of blue ointment vaseline have been satisfactorily used for laying and breeding hens affected with lice. A small amount, about the size of a pea, should be rubbed on the short feathers below the vent. The ointment should not be rubbed into the skin. The treatment is not advisable for setting hens, baby chicks, or for birds in a fattening battery.

Applying nicotine sulphate to the roosts is a very simple method of exterminating lice.

MITES

Poultry are attacked by several kinds of mites, commonly referred to as the red mite, the scaly-leg mite, the air-sac mite, and the depluming mite, depending on the part of the body they attack. They may be classified as those that spend their whole life on the bird, and those that remain on the bird for short periods only. Mites are not insects, but belong to the group of arachnids. Mites have four pairs of legs, and an oval-shaped, undivided body, which structure differentiates them from insects. Mites may remain for long periods without food in any stage of their development.

The red mite (*Dermanyssus gallinae*) is of special importance to poultrymen in Hawaii. It spends part of its life cycle in the cracks of the walls and floors, and in the nests, roosts, and dirt in the poultry house. The red mite is about one-twenty-ninth of an inch long. It is white or grayish in color when not filled with the blood of the host. The female lays her eggs in the crevices of the poultry house. The whole life cycle lasts for a week under favorable conditions.

The scaly-leg mite (*Cnemidocoptes mutans*) burrows beneath the scales on the legs, causing the scales to lift, the legs and the feet to swell, and an exudate which later hardens to issue from beneath the scales (Fig. 14).

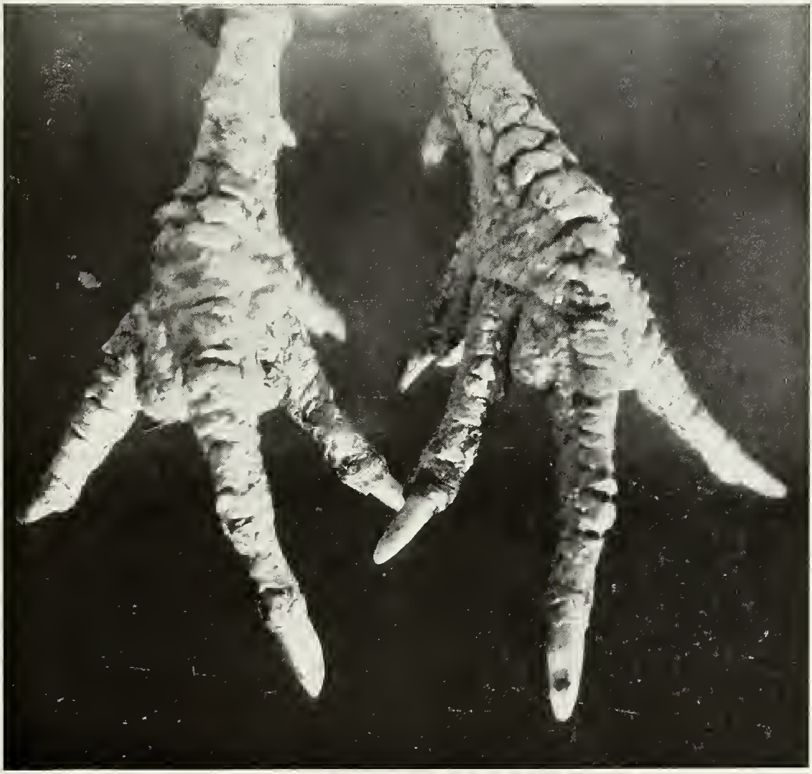


Fig. 14.—Scaly legs, the result of attack by the scaly-leg mite.

The air-sac mite (*Cytodites nudus*) is a small, yellow mite found in the air passages, liver, and lungs of the chicken.

The depluming mite (*Cnemidocoptes laevis*) burrows into the skin at the base of the feather and causes intense itching and irritation. Affected birds pull out their own feathers.

Treatment.—To eradicate the common red mite sanitation should be thoroughly practiced. The houses should be cleaned and then sprayed with creolin, or with any other good coal-tar product. The nests and the roosts should be painted with a coal-tar creosote oil. Crude oil mixed with kerosene, so as to make application easy, is very effective.

Scaly leg may be cured by applying a mixture of one part of oil of caraway to five parts of vaseline to the affected parts. Carbolated vaseline is also effective. If kerosene or crude oil is used, care should be taken not to burn the skin at the hock joint. A mixture of sulphur and lard makes a good salve to apply to the legs after they have been washed with soap and warm water.

Depluming scabies may be treated by applying a mixture of one part of flowers of sulphur with three parts of lard to the affected areas every four days. Dipping the birds in water containing soap and sulphur is also recommended. Two ounces of sulphur should be used to one ounce of soap in each gallon of lukewarm water. The dip should be kept stirred so as to keep the sulphur in suspension. The birds should be thoroughly dipped at least twice, with an interval of one week.

Prevention.—Cleanliness in the poultry house is the best preventive of mites. Mites thrive in dirt and multiply rapidly. The poultryman should be on the watch for them throughout the year.

STICKTIGHT FLEA

The sticktight flea (*Echidnophaga gallinaceae*) is commonly found on chickens in Hawaii. The flea attaches itself to the area about the face and the eyes, remaining there during the entire adult period. The eggs are laid in small openings in the skin where they hatch and whence the larvae fall to the ground. Eggs may also be laid in the poultry house and the resulting larvae fall on the litter. The larvae have chewing mouth parts and feed upon manure and other dirt in the poultry house or on the runs. The larvae appear to be small white caterpillars. Fully matured they inclose themselves in a cocoon, whence they emerge as adult fleas. The adult female attaches herself to the bird, engorges herself with its blood, and then lays a large number of eggs.

Treatment.—Infected parts of the head should be anointed with crude oil. Dipping the birds in a two per cent creolin dip is also recommended.

Prevention.—The poultry runs should be kept clean and sprayed frequently with a suitable disinfectant. The dropping boards, roosts, and nest boxes also should be sprayed regularly. The runs should be plowed, treated with lime, and planted with an early-maturing crop. Spraying the ground with water is very effective for flea control.

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